NOVA SCOTIA RESEARCH FOUNDATION CORPORATION
1989/90 ANNUAL REPORT

ssisting industry in Nova Scotia by solving technical problems and demonstrating the effective use of appropriate technologies.

TECHNOLOGY IN ACTION

90-07220/

CORPORATE PROFILE

Nova Scotia Research Foundation Corporation was established in 1946 by the Province of Nova Scotia to use science and technology to assist in the economic development of Nova Scotia.

Three operating divisions - Applied Science, Industry Services and Product Development - carry out technical assignments for 700 companies and government departments each year.

The Corporation pursues two main goals - assistance to industry in the solution of today's technical problems and product/process innovation in anticipation of tomorrow's opportunities.

APPLIED SCIENCE

Technical services and applied R & D for industry and government.

Laboratory Services

Analytical and Environmental Chemistry

- ☐ Lube oil and fuels analysis
- ☐ Environmental monitoring of process effluents
- ☐ Pressure-treated wood quality control
- ☐ Indoor air-quality monitoring
- ☐ Glassblowing

Biology

- ☐ Microbiological analysis
- ☐ Food quality and sanitation surveys

Materials

- ☐ Mechanical and metallurgical testing
- ☐ Welding procedure qualifications
- ☐ Failure analysis
- ☐ Corrosion Analysis

Research and Development

Coal & Mineral Technology

- ☐ Process development and economic studies
- ☐ Coal liquefaction R & D
- ☐ Spray testing and rheology studies
- ☐ Mineral utilization and industrial waste management

Biology

- ☐ Symbiotic plant-microbe interactions
- ☐ Plant tissue culture
- ☐ Fish freshness test development

Geophysics

- ☐ Data compilation, processing and interpretation
- ☐ Geophysical equipment development and sales

Materials R & D

- ☐ Ceramics
- ☐ Corrosion

INDUSTRY SERVICES

Technical assistance to small and medium-sized manufacturers to improve productivity and technological capabilities.

Field Service

- ☐ National Research Council's IRAP Program
- ☐ Technical information/literature searches
- ☐ In plant problem solving
- ☐ Technology transfer/acquisition
- ☐ Technology patent searches

Technical People in Industry Program

- ☐ Financial support for new skills to industry

Project Services

- ☐ Technical/market analysis
- ☐ Bioresource machine applications engineering
- ☐ Mathematics and computer applications

Library

- ☐ Computer database searches
- ☐ Technical searches

PRODUCT DEVELOPMENT

New Product Development

- ☐ Engineering
- ☐ Manufacturing
- ☐ Marketing
- ☐ Mechanical/electronic engineering and design assistance
- ☐ CAD/CAM familiarization

Export Sales

- ☐ Diving life-support equipment
- ☐ Underwater instrumentation
- ☐ Magnetically coupled "zero-leakage" blowers and pumps

Accident Reconstruction

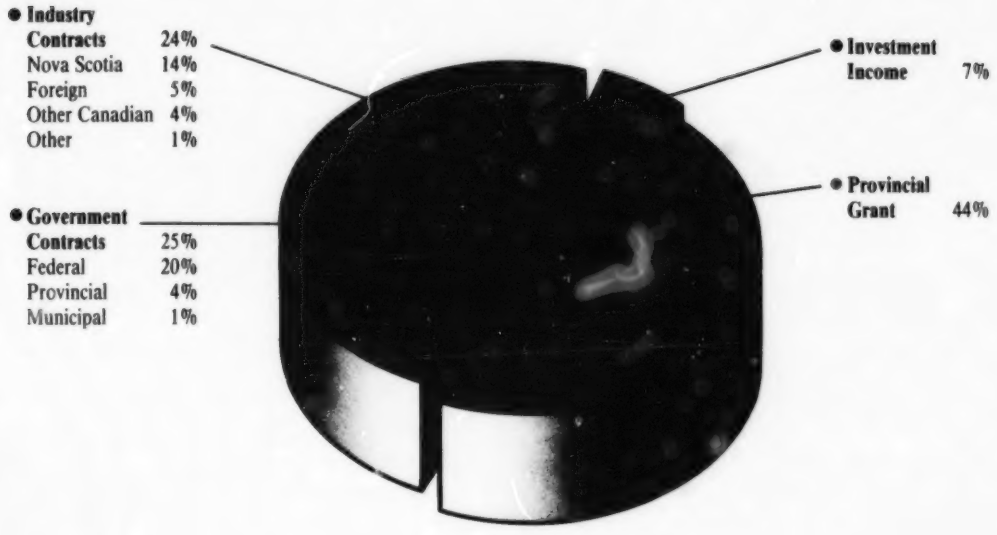
Environmental Testing

- ☐ Temperature
- ☐ Thermal shock
- ☐ Humidity
- ☐ Vibration
- ☐ Mechanical shock
- ☐ Hydrostatic pressure
- ☐ Altitude
- ☐ Salt fog/spray
- ☐ Rain
- ☐ Sunshine
- ☐ Fungus growth
- ☐ Package testing
- ☐ Combined environments

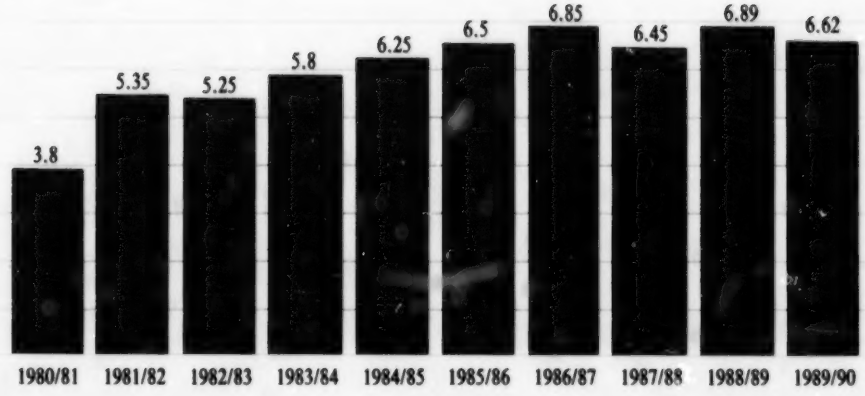
FINANCIAL SUMMARY

	1990	1989
Revenue		
Scientific and Engineering Contracts	**$3,250,736**	$4,001,242
Grant from Province of Nova Scotia	**2,912,000**	2,582,500
Investment Income	**453,878**	308,591
Expenses		
Science and Engineering	**5,031,070**	5,483,820
Administration and Occupancy	**1,574,168**	1,407,293
Net Income (Loss)	**$ 11,376**	**$ 1,220**

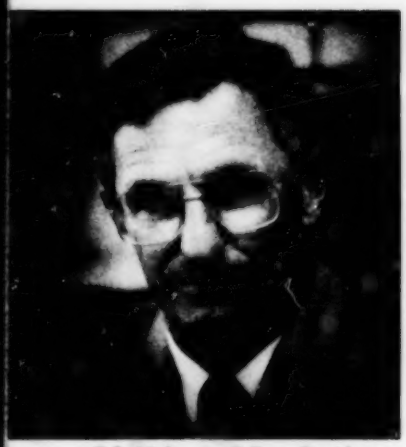
Sources of Revenue 1989/90



Ten Year Revenue Summary
Millions of Dollars



PRESIDENT'S REPORT



T.B. Nickerson, P.Eng., President

The Honourable Donald Cameron,
Minister
Department of Industry, Trade and Technology
Province of Nova Scotia
Halifax, Nova Scotia

Sir:

I have the honour of submitting the forty-third Annual Report of the Nova Scotia Research Foundation Corporation.

Respectfully yours,

T.B. Nickerson, P. Eng., President
Nova Scotia Research Foundation Corporation
Dartmouth, Nova Scotia
September 1, 1990

In the 1990's the combination of technological change and diminishing trade barriers will create opportunities for technology-intensive companies in many industries - and threats for companies not using the best technology available in their particular industry. The Nova Scotia Research Foundation Corporation, with its mandate to help industry adopt new technology, has emphasized three key organizational elements in responding to technology needs of our industrial clients throughout the province.

- ☐ Experienced field engineers who maintain close contact with clients and can respond quickly with practical technical assistance.
- ☐ R&D groups with indepth technical capability in major areas of client need.
- ☐ Networking with other organizations whose technological strengths complement those of the Corporation.

Networking enables the Corporation to access technical expertise throughout Canada and abroad to help our clients solve today's technical problem and seize tomorrow's market opportunity. The Corporation has agreements with eight Nova Scotia universities and technical institutions which allow us to call upon their expertise to assist our clients. In return NSRFC involves university staff and students in research linked to economic opportunities for Nova Scotia industry.

Through joint sponsorship with universities of the Applied Microelectronics Institute and the Atlantic Institute of Biotechnology, the Corporation has helped to develop strengths in two technologies that are vital to many companies in the province.

The Technology Innovation Centre adjacent to NSRFC, involving the Nova Scotia Departments of Industry, Trade and Technology and Small Business Development, is a full-service incubator mall helping entrepreneurs to overcome the initial hurdles in developing technology-intensive businesses. The Corporation participates in the Centre's management, and many of the 30 startup companies in the Centre use NSRFC's services.

The National Research Council's Industrial Research Assistance Program (IRAP) remains the most effective national program providing technology support for industry. NSRFC has been a participant in the IRAP network for almost 40 years and we regard IRAP as a major element of the Nova Scotia technology support system. The National Research Council is undergoing significant change as it prepares for the 21st century. Any proposed changes in IRAP will be assessed to ensure that the program continues to respond effectively to the varied needs of Nova Scotia industry.

NSRFC and its provincial research counterparts across Canada, through the Association of Provincial Research Organizations (APRO), utilize the collective strengths of our combined staff of 2,000 scientists and technologists. The APRO network, oriented to industry needs, is a powerful resource.

Industry continues to increase its use of the broad spectrum of R&D expertise available. The Corporation carried out 3600 technical assignments and contracts for 543 clients this year, ranging from straightforward literature searches to multidisciplined R&D projects. The divisional reports give highlights and details.

Total revenue declined 4% to $6,616,615. Completion of a long-term coal liquefaction contract and the licensing of our slip ring products to Focal Technologies Inc. resulted in an 18% decline in contract revenues. This was offset by increased support from the Province of Nova Scotia and increased interest income. With careful cost control, the Corporation achieved a modest net income of $11,377 on the reduced overall volume. New projects in chemical and mineral processing will replace coal liquefaction and royalties from the slip ring licensing agreement will begin in 1990/91.

The success of the Corporation is the result of the creativity and hard work of many talented people. Thank you to the staff and directors for their support, dedication and enthusiasm throughout the year. After year-end we welcomed three new members to the Board of Directors: Dr. Kelvin Ogilvie, Vice-President (Academic) of Acadia University; Mr. George MacKay, President of J.J. MacKay Limited; and Dr. Sonia Jones, President of Peninsula Farm Limited. An appreciative farewell to Dr. Jim McNiven, Dean of Management Studies at Dalhousie University and former deputy minister in the government of Nova Scotia, who retired after five years on the Board.

Our success depends on our ability to meet the ever-increasing technological needs of industry. We have emphasized networking to increase the range and depth of our expertise. The Corporation looks forward to working closely with its many partners to help industry address the technological challenges of the 1990's.

Board chairman Tom Nickerson (left) and U.C.C.B. president Dr. Peter Hill (right) at a meeting of the board of directors of the NSRFC held at U.C.C.B. last September.

APPLIED SCIENCE

RESEARCH & DEVELOPMENT

Biology

The Corporation collaborated with Dalhousie University and the Christmas Tree Council of Nova Scotia to initiate a research program directed towards the production of superior Christmas trees. The project will develop tissue culture cloning protocol for superior varieties of balsam fir.

We began supplying small fruit tissue cultures to Nova Scotia nurseries; micropropagation provides growers with disease-free planting stock.

Mycorrhizal fungi form symbiotic associations with the roots of forest trees and agricultural crops. Research funded under the Federal/Provincial Agricultural Agreement has shown that manipulation of mycorrhizal associations may help strawberry growers to produce better plants. Related work for the Canadian Forestry Service field-tested methods of applying mycorrhizal fungi to forest tree seedlings to improve growth and survival.

A study on woodchips used for fuel examined possible health hazards from airborne microorganisms and provided information on the safe handling and indoor storage of woodchips.

Coal and Mineral Technology

Pilot testing was completed on advanced direct liquefaction of Sydney-area coals. Through catalyst regeneration and activity tests, we demonstrated that controlled oxidation can restore the activities of aged catalyst to high levels rendering it suitable for reuse. The Federal Department of Energy, Mines and Resources and the Nova Scotia Department of Mines and Energy fund this project.

We assisted the Alberta Department of Energy in its evaluation of the feasibility of piping fuel-quality coal slurries. Atomization tests were carried out on coal-water fuel (CWF) samples provided from preparation facilities in West Germany.

The scale-up parameters of a National Research Council-designed nozzle were tested using liquids simulating the characteristics of heavy fuel oil.

The second phase of a study on the production of barium chemicals, under contract with Conwest Exploration Company Limited, has been completed. Phase Two concentrated on laboratory testing to assess the technical feasibility of converting Lake Ainslie barite into high-grade barium chemicals.

Corrosion Engineering

A research program on the stress corrosion behaviour of a modified copper alloy began this year. The project, funded by the Defence Research Establishment Atlantic, will assess the susceptibility of the alloy to stress corrosion cracking in seawater service.

Geophysics

Geophysics data-related projects included the interpretation and assembly of data on surficial sediment thicknesses on the Scotian Shelf for acoustic modelling; further gravity modelling in the carboniferous Cumberland Basin; seismic profile interpretation for New Brunswick evaporites, and reinterpretation of seismic profiles using new borehole information for the Point Aconi power station water intake.

Companies on both coasts of Canada and in Britain purchased marine geophysics equipment manufactured by the Geophysics Section.

The Section carried out a marine bathymetric and seismic profiling survey at Caribou, Nova Scotia to provide surficial sediment thicknesses for the dredging of shipping channels. We logged four groundwater holes at Pictou, Nova Scotia, and a borehole for brine dispersion at Sussex, New Brunswick.

Private geophysical contract survey companies now provide a strong support base to meet industry and government survey needs in Nova Scotia, therefore, the Corporation has withdrawn from this work. The Geophysics Section continues to provide geophysical and geological data processing, database information and interpretation; and equipment design, manufacture and repairs.

LABORATORY SERVICES

Analytical & Environmental Chemistry

There was a steady demand on our chemical analysis services. Subjects of analyses ran the gamut from used lubricating oil (accredited by the Standards Council of Canada) to fish meal to pressure-treated wood. Analysis of waste products to help companies determine the appropriate method of disposal expanded both for waste oil and other leachable pollutants.

Environmental assessments have been conducted for a number of water contaminants, and the number of indoor air quality surveys in offices and industrial establishments has grown. Asbestos removal has resulted in large numbers of samples for asbestos fibre analysis.

Materials

Materials services this year included failure analysis of boiler tubes, assessment of structural properties of masonry blocks and ties, and the testing of an aircraft engine frame.

Forensic studies have involved a variety of vehicle problems including fires and brake drum failure, together with investigations relating to the failure of temporary decking.

Microbiology

Industry and government clients used our microbiological services to test for various bacteria, yeasts and molds in water, food, plant effluents and fuels.

Listeria is now recognized as a potential problem in the food-processing industry. The Microbiology Section participated in Health and Welfare Canada's method development program and now offers a testing service for this bacterium. *Listeria* testing is included in our numerous sanitation surveys of food-processing and preparation establishments.

Glassblowing

Glassblowing services include repairing glass milking jars for Nova Scotia dairy farmers, custom manufacturing of specialized quality glassware for research laboratories, and advising industry on glass-related matters.

"NSRFC's Microbiology Group is doing a great job for us, meeting deadlines and providing quality work."

K.W. Hermes
Manager, Quality Assurance Services
The Quaker Oats Company of Canada Limited
Peterborough, Ontario

Greenhouse care of micropropagated strawberry plants.

INDUSTRY SERVICES

"The contribution from National Research Council's IRAP Program and NSRFC to our engineering research has enabled us to continue, with confidence, the construction of timber-framed structures. The establishment of a strong technical base has helped secure the jobs of our employees and the future of Scotia Post & Beam."

David Spence, President
Scotia Post & Beam Inc.
Port Williams, Nova Scotia

Field Service

The Field Service is the Research Foundation's main link to small business. For over 30 years, the National Research Council has supported the Field Service in the form of a Contribution Agreement for the Industrial Research Assistance Program (IRAP). This national program provides assistance in solving technical problems and in applying new technology to industry. Access to technical expertise around the world is available through the Industrial Technology Advisor (ITA). The ITA also initiates IRAP funding assistance programs.

The NRC's IRAP program currently supports five ITA's and one CTA (Construction Technology Advisor), and the Province of Nova Scotia supports one ITA. In addition to the Dartmouth office there are field offices in Truro, Sydney and Wolfville.

In 1989-90, field staff visited 1,800 clients, answered more than 3,600 inquiries, and carried out several in-depth technical projects. Funding assistance for Nova Scotia companies from the IRAP and Technology Inflow Program (TIP) last year amounted to approximately $1.3 million.

Project Services

Engineering development and feasibility studies over the past year resulted in, for example, an improved fish-skinning machine, a waste-paper handling facility and a well-liner.

On behalf of the Atlantic Farm Mechanization Institute we evaluated hay-compacting machines, assisted with an innovative orchard spraying system and performed a cost analysis of forage production systems in Atlantic Canada. Halifax County's Aerotech Park received assistance in the form of a Marketing Director to help devise a long-term marketing and business strategy. Work continued on technical appraisals for the various industrial development activities of Enterprise Cape Breton.

Technical People In Industry

Transferring technology to a company or improving its existing technology requires some in house technical expertise. However, in Nova Scotia over 70% of small manufacturers do not have a scientist, engineer or technologist on staff.

ACOA (Atlantic Canada Opportunities Agency) accepted our proposal to demonstrate the positive impact of new technical skills primarily to smaller companies. The program supports added technical staff members in firms by reimbursing a portion of their salaries for up to one year. The added technical skills must be new to the business in order to demonstrate to management the benefit of employing technical people. An advisor enhances the results by helping to make links to the science and technology community.

Formally begun on January 1, 1989, after fifteen months the program had reviewed 44 formal applications, approved 36 projects and committed $416,281 in the manufacturing, processing, agriculture, aquaculture, technical service and forestry sectors.

Library

A collection of approximately 20,000 books, journals and reports, an active inter-library loan procedure and access to over 400 databases on seven systems enables our Library to provide information, and access to information sources, to all divisions of the Corporation.

Promoting the Technical People in Industry program across Nova Scotia.

PRODUCT DEVELOPMENT

Technology Transfer

The transfer of our rotary product line to Focal Technologies Inc. of Dartmouth has progressed well. Focal have more than met their first-year sales objectives and have been very successful at bringing in new applications for the technology, resulting in new opportunities for the company.

Nova Magnetics Limited

The transfer of the rotary product lines to Focal Technologies Inc. has enabled the Division to focus on the opportunities offered by our magnetic drive technology.

Nova Magnetics Limited, our wholly-owned subsidiary, returned to the marketplace with a new direction and impetus. Recently patented low-loss magnetic drives are the ideal new technology to meet the need for environmental protection. The use of seal-less, leak-free, magnetic drives in chemical, nuclear and petrochemical applications eliminates a toxic leakage problem prevalent in many of these industries.

In the past, Nova Magnetics had a few market niches in highly specialized blower and pump applications but no high-volume opportunities had been realized. The advantage of our new patented technology for low-loss magnetic drives is efficiency. The technology reduces eddy current losses by several orders of magnitude and opens the application scope to much higher speeds and horsepowers while retaining the advantages of leak- and maintenance-free shaft sealing.

Our approach has been to work co-operatively with pump manufacturers to provide a complete seal-less pumping system incorporating this new technology. Nova Magnetics will manufacture and supply the vital magnetic drive, inner drive and barrier to these pump manufacturers. Once the technology is established in the marketplace, NML will seek Nova Scotia partners for a transfer of this opportunity to the private sector.

CAD/CAM Services

NSRFC uses CAD/CAM and is mandated through the Federal-Provincial Sub-Agreement on Technology Transfer to assist others in its application. The delivery of CAD/CAM assistance to Nova Scotia industry has been increased through direct advertising, mailouts and client referrals. Many satisfied Nova Scotia companies are now effectively using this modern technology in their day-to-day business.

Quality Assurance Services

Quality control and assurance has become a vital part of our operations Believing that quality is one of the key factors in industrial competitiveness, we continue to assist companies in implementing quality programs in their operations. Over the year, we provided direct consulting assistance to ten companies and extensive in-plant assistance to another five.

Environmental Test Services

Funding from ACOA and the Province provided the beginnings of the Environmental Test Centre Atlantic. This year's ETC Atlantic activities included the design and contracting of a new 5,000-square-foot building on the NSRFC campus in Dartmouth and the specification and acquisition of the test equipment. Marketing efforts were commenced to build a client base for the Centre.

ETC Atlantic offers a wide range of environmental exposure testing, including temperature, altitude, humidity, thermal shock, vibration, mechanical shock, salt spray, rain, sunshine, high-pressure immersion, transport simulation and fungus exposure.

Client Services

The Division continues to serve clients in the fields of design and drafting, precision machining, forensic engineering and new product design and marketing.

> They (NSRFC) bent over backwards to help me out in the purchase, set-up and training for CAD/CAM equipment...the expertise is there!
>
> *Gerald Gosbee*
> *Gosbee Products Limited*
> *Amherst, Nova Scotia*

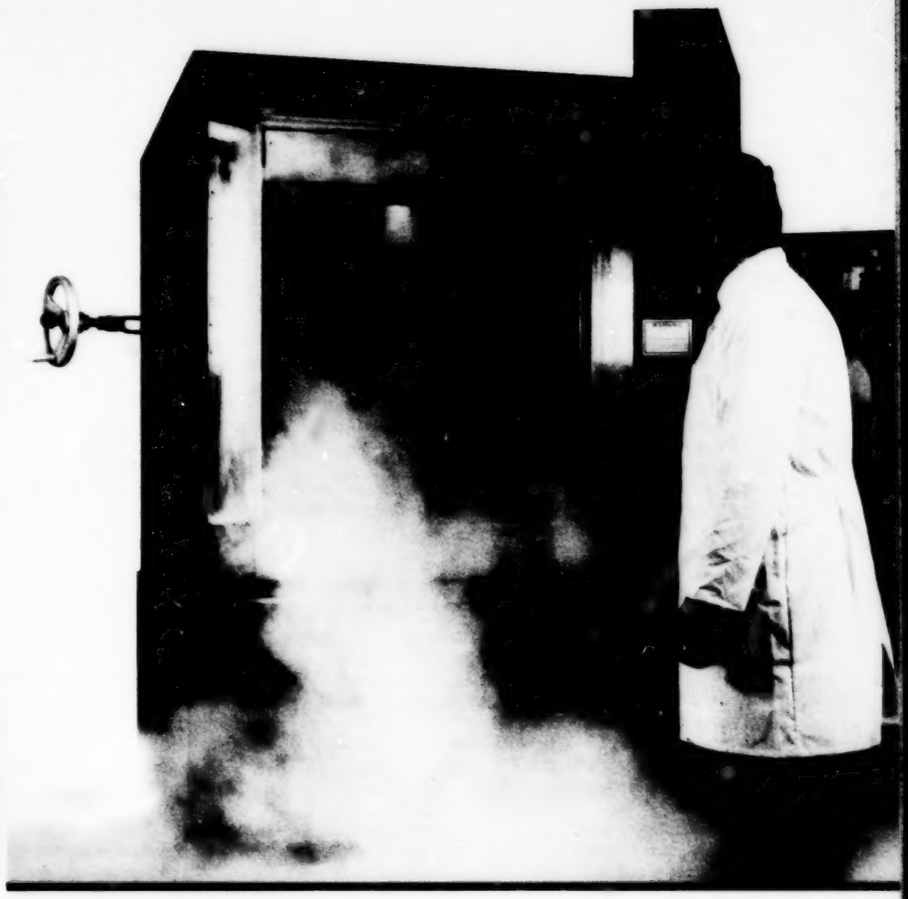
Assembly of a Nova Magnetics Ltd. model 120 regenerative blower for export to the United States.

ENVIRONMENTAL TEST CENTRE ATLANTIC

No, we do not test the environment! The new Centre tests products and equipment in the environmental conditions for which they were designed. The Centre simulates Arctic temperatures, equatorial sunshine, the pressure at the ocean floor or – a fungus attack! It's "Nightmare on Research Drive" for the subjects of environmental testing, but that is how we make sure products and equipment will do their jobs in the real world.

In addition to simulated environment testing, the Centre will provide materials testing services and a comprehensive test consultation service.

▲ *Walk in chamber capable of temperature range of – 73°C to + 85°C and humidity range of 20 to 95% relative humidity.*



Hydrostatic pressure testing to 1000 p.s.i. of equipment designed for ocean use. ►

▲ *Set up for vibration testing. Shaker/sliptable can produce up to 12,500 pounds of force for random or sine vibration.*

SUMMARY OF SERVICES

Simulated Environment Testing
- Temperature
- Thermal shock
- Humidity 20% to 95% rh
- Vibration
  - Sine, random or sine-on-random
  - Road transportation simulation
- Mechanical shock
  - Classic shock (specified pulse)
  - Shock response spectrum
  - Navy class high impact (light weight)
- Hydrostatic pressure
- Altitude
- Salt fog/spray
- Rain
- Sunshine
- Fungus growth
- Package testing
- Combined environments
  - Temperature/humidity
  - Temperature/altitude
  - Temperature/humidity/vibration

Materials Testing
- Tensile and compressive tests
- Impact (charpy) testing
- Hardness testing
- Weld qualification tests
- Crack propagation
- Stereoscopic and metallurgical microscopy
- Corrosion and erosion rates
- Soil stability compression load
- Differential thermal analysis
- Heat treatment facilities

Test Consulting Services
- Specifications interpretation
- Test plan development
- Failure analysis
- Design consultation
- Thorough test reports

▲ *Temperature shock test at – 70°C Chamber temperatures range from – 73°C to + 200°C.*

AFFILIATES

IRAP and the Field Service

Visualize a small Nova Scotia firm who uses indigenous resources and/or satisfies a local market. The firm may be in manufacturing, processing, construction or technical services. It probably has five to fifty employees.

This small firm faces increased competition from outside the region for substitute products - usually cheaper and perhaps technologically superior. Sometimes the competition takes shape as faster deliveries because of modern manufacturing processes or as superior quality resulting from better equipment and formalized quality control programs.

The National Research Council's Industrial Research Assistance Program (IRAP) provides Nova Scotia firms with a means of becoming technologically competitive. Through IRAP a company can acquire the technical people skills required to solve a production problem, develop a new product or upgrade quality assurance or even management information systems.

In Nova Scotia the IRAP team is made up of twelve industrial technology advisors (ITAs) located throughout the province. Nova Scotia Research delivers the services of six of these ITAs, who function as staff of our Field Service section.

Each ITA is a professional engineer or scientist who had significant industrial experience before joining our team. He is the primary contact with the businesses in his territory and as a result has the opportunity to get to know and understand the clients. The ITA provides technical help to clients personally and through other IRAP specialists nationwide. Other times the ITA will access specialists outside of IRAP with the cost of consultants or new technical or scientific staff partially covered by one of the IRAP contribution programs.

Since technological advancement continues to accelerate, our challenge continues. The IRAP Program is only as far away as the telephone - see "Technology" in the yellow pages.

The Atlantic Institute of Biotechnology (AIB)

The mission of the Atlantic Institute of Biotechnology (AIB) is to assist industry in applying biological technology to increase productivity, competitiveness and profitability. The Institute acquired a new Executive Director, Bill MacLennan, this year and is planning extensive marketing in order to increase its service to Atlantic Canada businesses.

Applied Microelectronics Institute

The Applied Microelectronics Institute (AMI) develops solutions in the application of advanced electronic systems, usually on a contract basis.

Last year saw a range of projects utilizing our expertise in high-performance real-time systems. We are introducing new systems at AMI to enhance computer-aided electronic engineering design.

Founded in 1981 by the Technical University of Nova Scotia, Dalhousie University and Nova Scotia Research Foundation Corporation, the organization continues its autonomous growth, with 1989/90 revenues increasing to $1.8 million.

The Technology Innovation Centre

Opened in September 1987, this full-service business technology incubator provides an atmosphere for accelerated growth to technology-based start-up companies.

The Centre's thirty tenants represent a diversity of technological enterprise such as design and manufacture of helicopter training simulators, design of aquaculture systems, biochemical and bioclinical labs and solar-powered equipment manufacturing. During 1989/90 fiscal year several of our businesses grew substantially and four companies graduated into the local commercial community.

Built as a joint federal/provincial project, the Technology Centre is operated by the Nova Scotia Department of Industry, Trade and Technology.

Atlantic Farm Mechanization Institute

The Atlantic Farm Mechanization Institute (AFMI) was created as a non profit corporation in 1985 to carry out research, development and testing of agriculture and woodlot machinery in and for Atlantic Canada. Among this year's projects were evaluation of straw spreaders for blueberry mulching, evaluation of hay compactors and assistance in assessing chemical spraying equipment.

The Institute is administered by a Board of Directors made up of farmers, extension agricultural engineers and representatives of the farm machinery industry. As an "institute without walls," AFMI draws together expertise and resources from various other institutions and firms within the region.

Managed by the Nova Scotia Research Foundation Corporation under the direction of the Institute's Board of Directors, the institute works on a contract basis for individual clients and agencies.

PAPERS, PUBLICATIONS AND PATENTS

Hellenbrand, K.
"Air Quality Impacts of Woodchip Fuel Piles," Proceedings of the 7th Canadian Bioenergy R&D Seminar, Ottawa, Ontario, April 24-26, 1989.

Hellenbrand, K.
"Development of Procedures for Inoculating Certified Strawberry Stock with Endomycorrhizal Fungi," presented at the Rhizosphere Research Workshop, Ottawa, Ontario, October 11-13, 1989.

Matthews, J.R.; Betancourt, T.; Robicheau, M.
"Statistical Behaviour of Fatigue Crack Growth for HY-80 Steel Plate and its Weldments under Cathodic Protection in Seawater and in Air," *Eng. Fracture Mech.* Vol. 34, No. 4, pp. 785-802, 1989.

McKay, A.G.; Howells, K.
"Seismic Profiling Investigation of a Small Area North of Sable Island, Scotian Shelf," *Atlantic Geology*, 25(2), page 165, 1989.

Starzomski, J.J.
"Advanced Two-Stage Direct Liquefaction of Nova Scotia Coal," presented at the Joint Technical Meeting for Canada-Japan Coal Liquefaction Cooperation, Ottawa, Ontario, October 11-12, 1989.

Stover, N.S.H.; Thambimuthu, K.V.; Todd, A.
"Characterization of the Coal-Water Fuel Fly-Ash Emissions from an Industrial Steam Boiler," presented at the 14th International Conference on Coal and Slurry Technology, Clearwater, Florida, April 24-27, 1989.

Taiani, P.M.
Canadian and U.S. patent applications entitled "Sealed and Pressure-balanced Oil Lubrication System."

Taiani, P.M.
U.S., Japanese and European patent applications entitled "Low-loss Magnetic Drive Systems."

NSRFC IN THE COMMUNITY

Archibald, G.
Member, Alumni Executive Technical University of Nova Scotia

Member, Association of Professional Engineers of Nova Scotia - Finance Committee

Member, "Technology For Profit and Survival" Conference, Steering Committee, October 1989

Betancourt, T.
Mentor for Engineers-In-Training for the Association of Professional Engineers of Nova Scotia

Bidgood, D.E.T.
President, Nova Scotia Institute of Science

Member, Energy Sector of Voluntary Planning

Cervelli, R.L.
President, Atlantic Plant Tissue Culture Association

Glass, I.W.
Committee Member, Association of Professional Engineers of Nova Scotia - "Placement Counselling Program"

Hellenbrand, K.E.
Member, Board of the Atlantic Institute of Biotechnology

Member, Dartmouth Lakes Advisory Board

Helliwell, J.R.
Member, Economic Development Committee of the Halifax Board of Trade

Council Member, Nova Scotia Institute of Science

Adjudicator of Invention Section for Canada Awards for Business Excellence

Howells, K.
Treasurer, Geological Association of Canada and Mineralogical Association of Canada

Councillor, Atlantic Geoscience Society

Member, Nova Scotia Remote Sensing Committee

Committee Member, Atlantic Centre for Remote Sensing of the Oceans

Fellow, Geological Association of Canada

Kazi, H.A.
Appointed Adjunct Professor, Technical University of Nova Scotia

Special Lecturer, Technical University of Nova Scotia

Member, Organizing Committee for the Canadian Institute of Mining and Metallurgy's 28th Annual Conference at the Halifax Sheraton, August 1989

MacAulay, J.D.
Council Member and Chairman, Research and Education Committee of the Nova Scotia Institute of Agrologists

Member, Board of Governors of the Agricultural Institute of Canada Research Foundation and its' Research Priorities Committee

Member, Expert Committee on Mechanization of the Canada Committee on Engineering Services in Agriculture and Food

Member, Atlantic Committee on Agricultural Engineering Advisory Committee on Agricultural Power and Machinery

Mentor for Engineers-In-Training for the Association of Professional Engineers of Nova Scotia

Special Lecturer, Technical University of Nova Scotia

MacIntyre, S.
Member, Mechanical Technology Advisory Committee, the University College of Cape Breton

MacNeill, R.F.
Council Member, Dartmouth Chamber of Commerce. Chairman of Dartmouth City Beautification Awards Committee

Marshall, J.J.
Member, Offshore Trade Association of Nova Scotia Program Committee

McKay, A.G.
Treasurer, IEEE Oceanic Engineering Society, Nova Scotia Chapter

Vice-Chairman, Dartmouth City Recreation Advisory Board

Nickerson, T.B.
Vice-President, Association of Provincial Research Organizations of Canada

Chairman, Applied Microelectronics Institute

Vice-Chairman, Nova Scotia Council of Applied Science and Technology

Chairman, "InnovatioNS" Newsletter

Chairman, Board of Directors of the Discovery Centre

Chairman, APENS 1989 Science and Technology Conference Committee

Board Member, Acadia Institute

Osborne, J.T.
Secretary, IEEE Oceanic Engineering Society, Canadian Atlantic Chapter

Roberts, R.L.
Member, Board of Directors, Haltrans Industries (occupational training)

Senior Officer, Naval Reserve

Simmons, R.D.
Executive Member, Canadian Institute of Food Science and Technology (Nova Scotia Chapter)

Member, Advisory Committee on Food Processing and Engineering

Professional Member, Nova Scotia Institute of Agrology

Treasurer, Nova Scotia Section of the American Society of Quality Control (ASQC)

Director, Valley Chapter of the Nova Scotian Institute of Science

Starzomski, J.J.
Nova Scotia Representative on Canada-Japan Coal Liquefaction Working Group

Stover, N.S.
Mentor for Engineers-In-Training for the Association of Profesional Engineers of Nova Scotia

Sutherland, F.A.
Executive Board Member, Human Resource Development Association (HRDA)

Special Lecturer and Undergraduate Thesis Supervisor, Technical University of Nova Scotia

Mentor for Engineers-In-Training for the Association of Professional Engineers of Nova Scotia

Member, Nova Scotia Technology Committee for the Canadian Manufacturers Association

Member, Technology Committee, Voluntary Economic Planning

Thorpe, J.W.
Chairman, Environmental Management Committee, Dartmouth Chamber of Commerce

Member, Dartmouth Community Awareness and Emergency Response Organization

Treasurer, Environment Division, Chemical Institute of Canada

Tyner, C.R.
Past Chairman, Canadian Maritime Section of the Marine Technology Society

Williams, L.M.
Member, Technical Committee of the Canadian Homebuilders Association of Nova Scotia

Member, APENS Consulting Practise Committee

NSRFC participation in Burnside/Dartmouth Corporate Challenge.

AUDITOR'S REPORT

To the Chairman and Members of the
Board of Directors of the
Nova Scotia Research Foundation Corporation

I have examined the balance sheet of the Nova Scotia Research Foundation Corporation as at March 31, 1990 and the statements of revenues and expenses and retained earnings for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Corporation as at March 31, 1990 and the results of its operations for the year then ended in accordance with the accounting policies stated in Note 2 to the financial statements, applied on a basis consistent with that of the preceding year.

O.P. Cormier, F.C.A.
Auditor General
Halifax, Nova Scotia
May 25, 1990

Balance Sheet
as at March 31, 1990

Assets	**1990**	1989
Current		
Cash	**$ 1,286,704**	$ 1,036,705
Short-term investments	**3,559,309**	495,270
Accounts receivable	**787,271**	1,432,968
Inventory	**35,010**	121,541
Work in progress	**65,922**	50,508
	5,734,216	3,136,992
Funds and investments (Note 3)		
Research Endowment Fund	**1,000,000**	1,000,000
Nova Scotia First Fund	**11,261,763**	10,000,000
Other investments	**13**	13
	12,261,776	11,000,013
Fixed Assets		
Land and buildings	**2,873,132**	2,843,267
Equipment	**1,948,180**	1,920,997
	4,821,312	4,764,264
	$22,817,304	$18,901,269

Liabilities and Equity	**1990**	1989
Current		
Accounts payable		
Trade	**$ 641,435**	$ 271,506
Province of Nova Scotia	**4,057,218**	2,130,886
Deferred revenue	**534,028**	244,442
	5,232,681	2,646,834
Fund Balances		
Research Endowment Fund	**1,000,000**	1,000,000
Nova Scotia First Fund	**11,261,763**	10,000,000
	12,261,763	11,000,000
Equity		
Contributed surplus	**4,821,312**	4,764,264
Retained earnings	**501,548**	490,171
	5,322,860	5,254,435
	$22,817,304	$18,901,269

Loan Guarantees (Note 4)

AUDITOR'S REPORT

Statement of Retained Earnings
For the Year Ended March 31, 1990

	1990	1989
Balance, beginning of year	$490,171	$488,951
Add: Net income	11,377	1,220
Balance, end of year	$501,548	$490,171

Statement of Revenues and Expenses
For the Year Ended March 31, 1990

	1990	1989
Revenues		
Contracts (Note 5)	$3,250,736	$4,001,242
Grant from Province of Nova Scotia	2,912,000	2,582,500
	6,162,736	6,583,742
Expenses		
Scientific and engineering	5,031,070	5,483,820
Administrative and occupancy	1,574,168	1,407,293
	6,605,238	6,891,113
Loss Before Investment Income	442,502	307,371
Investment Income		
Research Endowment Fund	114,415	102,540
Short-term investments	339,464	206,051
	453,879	308,591
Net Income	$ 11,377	$ 1,220

Notes to the Financial Statements
March 31, 1990

1. **Authority**
The Nova Scotia Research Foundation Corporation was established in 1975 by the *Act to Establish the Nova Scotia Research Foundation Corporation*. Its purpose is to assist in the economic development of Nova Scotia by promoting, stimulating and encouraging the effective utilization of science and technology by industry and government.

2. **Accounting Policies**
These financial statements have been prepared in accordance with generally accepted accounting principles modified by the Corporation's accounting treatment of fixed assets described in (c) below.
a) *Short-term investments:* Short-term investments are valued at the lower of cost or net realizable value.
b) *Inventory and work in progress:* Inventory and work in progress are valued at the lower of cost or net realizable value.
c) *Fixed assets and contributed surplus:* Fixed assets are acquired by purchase, donation or construction. The costs of purchased capital additions and the fair market values of donated capital additions are recorded as fixed assets with an offsetting credit to contributed surplus. When fixed assets are constructed by the Corporation, the related material, labour and overhead costs are included as fixed assets in the year of expenditure. When fixed assets are acquired out of the general revenues of the Corporation, they are charged to expenses in the year of acquisition. When the costs of equipment have been carried on the Corporation's financial statements for ten years, that cost is removed from both the fixed asset and contributed surplus accounts.
d) *Government assistance:* Funds received for the acquisition of equipment are offset against the cost of this equipment. Funds received for operating expenses incurred are recorded as revenue in the same year as the expenses were incurred.

3. **Funds and Investments**
Research Endowment Fund - Subject to any directions provided by the Governor in Council, the fund is administered and controlled by the Corporation. The Fund is invested in a Province of Nova Scotia 12.05% promissory note which will mature November 16, 1990.
Nova Scotia First Fund - On March 30, 1989 the Governor in Council approved an appropriation in the amount of $10,000,000 to establish the Nova Scotia First Fund. The objective of the Fund is to encourage the development of high-technology industries and the adaptation of new technologies in existing industries. The Corporation has appointed a committee to manage the Fund and is currently formulating terms of reference. At March 31, 1990 the Fund was invested as shown below.*
Other Investments: - Other investments consist of a 20% ownership of Pathfinder Med Limited at a stated cost of $10, and a 100% ownership of Nova Magnetics Limited at a stated cost of $3. Nova Magnetics Limited ceased active operations on April 1, 1987. Management has decided that effective for the 1989 fiscal year the financial statements of Nova Magnetics Limited will no longer be consolidated with those of the Corporation.

4. **Loan Guarantees**
The Corporation has provided a total guarantee of $50,000 to the Royal Bank of Canada as security for a loan and line of credit from the bank to the Applied Microelectronics Institute.

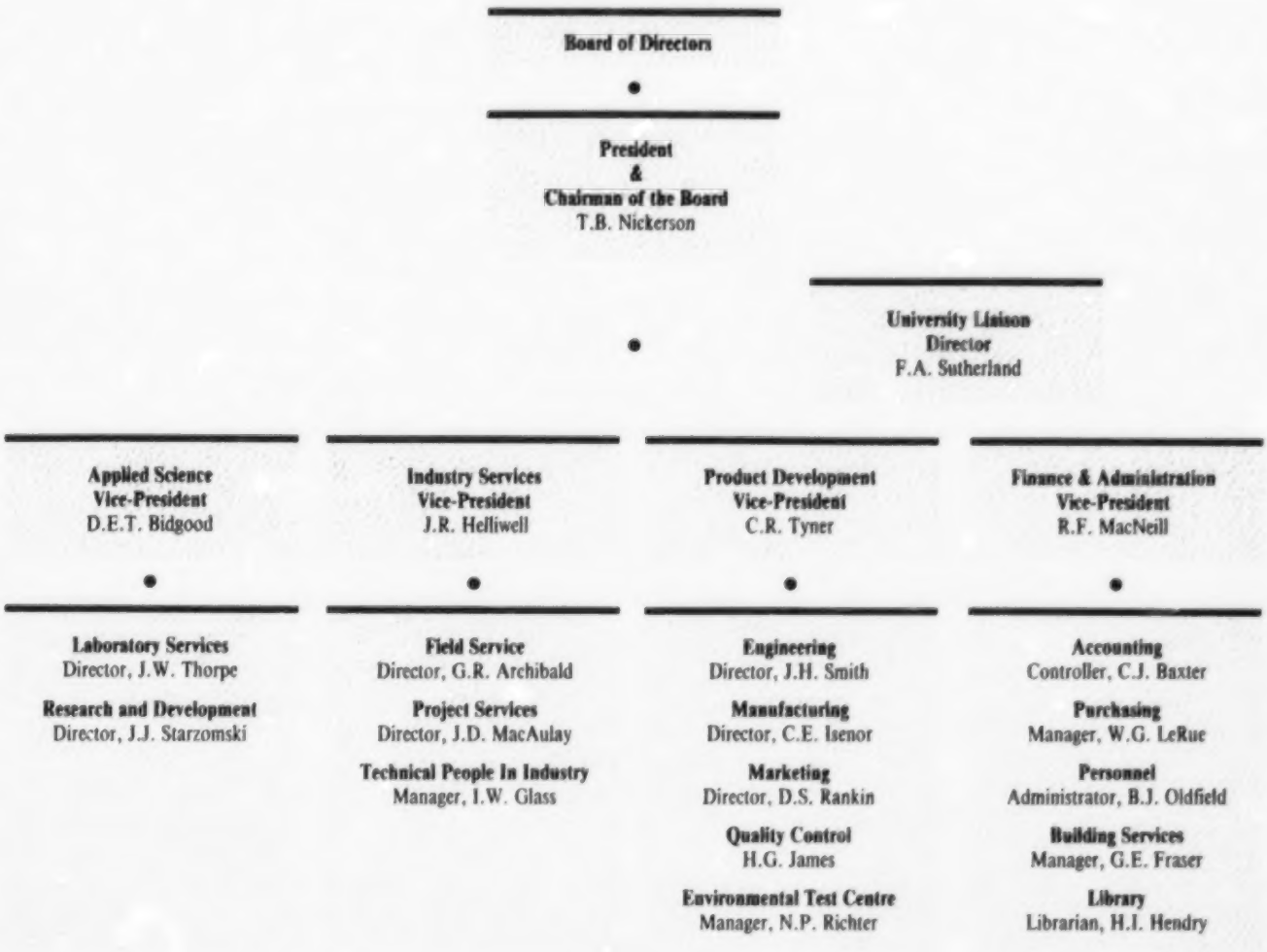
5. **Government Assistance**
Contract revenues include government assistance of $67,713 (1989 - $129,172) for expenses incurred under various federal and provincial agreements.

6. **Commitments**
The Corporation is constructing a new building to house an environmental test centre (ETC Atlantic). The budgeted costs to construct and equip the facility are $2,440,000. The Atlantic Canada Opportunities Agency (ACOA) has agreed to provide capital funding of $1,500,000, the Province of Nova Scotia has contributed $460,000 and $480,000 is being contributed by the Corporation In addition, ACOA has agreed to fund up to $550,000, over four years, should revenues generated from industry contracts not be sufficient to meet operating costs. Total capital incurred to date approximate $650,000.

7. **Reclassification of Prior Year's Figures**
Certain of the prior year's figures have been reclassified to conform to the current year's presentation.

*Investment	Amount	Rate	Maturity Date
Guaranteed Investment Certificate	$ 5,358,356	12.00%	May 18, 1990
Guaranteed Investment Certificate	5,903,407	13.40%	July 30, 1990
	$11,261,763		

ORGANIZATION CHART



NSRFC BOARD OF DIRECTORS As at March 31, 1990

* **Mr. T.B. Nickerson, P. Eng.**
Chairman of the Board
President
Nova Scotia Research Foundation Corporation
Dartmouth, NS

Dr. J.E. Blanchard
Halifax, NS

Mr. J.C. Callaghan
Halifax, NS

* **Mr. M.A. Eisenhauer**
President
ABCO Limited
Lunenburg, NS

* **Mr. P. Ferguson**
Operations Manager
Distribution/Atlantic
ESSO Petroleum Canada
Dartmouth, NS

Mr. D.H. McKeough
New Glasgow, NS

Dr. J.D. McNiven
Dean, Faculty of Management Studies
Dalhousie University
Halifax, NS

Mr. T.G. Merriam
Deputy Minister
N.S. Department of Industry, Trade & Technology
Halifax, NS

* **Mr. W.O. Morrow**
Chairman of the Board
National Sea Products Limited
Halifax, NS

Dr. W.S. Shaw
Chairman, Geology Department
St. Francis Xavier University
Antigonish, NS

Mr. J.E. Terry
Chairman of the Board
DEVCO
Sydney, NS

Mr. R.F. MacNeill
Secretary to the Board of Directors
Nova Scotia Research Foundation Corporation
Dartmouth, NS

* Members of the Executive Committee of the Board of Directors

STAFF As at March 31, 1990

PRESIDENT'S OFFICE

President
T.B. Nickerson, B.Eng., M.Sc., P.Eng.

Secretary
N.J. Gerogiannis

University Liaison
F.A. Sutherland, B.Eng., M.Eng., P.Eng.

FINANCE & ADMINISTRATION

Vice-President, Finance & Administration
R.F. MacNeill, B.Sc., B.Comm.

Personnel Administrator
B.J. Oldfield

Controller
C.J. Baxter, B.Comm., C.A.

Accounting
R. Chaffey
M.L. Creamer
J.P. MacDonald

Computer Administration
E.P. Arsenault, B.Eng., P.Eng.

Purchasing
W.G. LeRue
J.M. Foster
E.P. Kelly

Receptionist
J.D. Steeves

Building Services
G.E. Fraser, Dip. Mach.
J.F. Brown
P.S. Mugridge, Elect. Tech.
H.J. Parusel, Auto. Tech.
R.A. Reid
B.S. Gandhu
J.S. Benjamin
G.E. Dean
F.G. Walsh
J.A. Weatherup
D.G. Young

Innovation and Design
P.M. Taiani

The Technology Innovation Centre
M. Mallis
F. Rose
P. Woods

APPLIED SCIENCE

Vice-President, Applied Science
D.E.T. Bidgood, B.A., M.A., Ph.D.

Secretaries
J.M. Colpitts
C.A. MacDonald

Laboratory Services
J.W. Thorpe, B.Sc., M.Sc., Ph.D., M.B.A.
B.P. Boudreau, Chem. Tech.
W.E. Dearman, B.Sc.
M.J. Firth
G.G. Fraser, Chem. Tech.
W.R. Gillis, B.Sc.
P. Graham, Bio. Tech.
H.F. Irving, Chem. Tech.
H.A. Kazi, B.Sc.Eng.,M.Eng., Ph.D., P.Eng.
J.S. MacIntrye, B. Eng., P.Eng.
M.J. MacGillivray, Chem. Tech.
P.C. Malley, Chem. Tech.
R. Maxwell, Glassblowing Tech.
R.G. Mombourquette
M. Murray, B.Sc.
S.A. Payson, Chem. Tech.
A.E. Reade, B. Tech., Ph.D.
M.L. Robicheau, B.Sc., M.Ap.Sc.
H.B. Stillman, B.Sc.
M. Stow, B.Sc.
S.G. Thomas, Chem. Tech.
K.L. Viet, Bio. Tech.

Research and Development
J.J. Starzomski, B.Sc.
T.K. Betancourt, B.Eng., M.Eng., P.Eng
H.L. Brown, B.Sc.
R.L. Cervelli, B.Sc., M.Sc.
D.E. Clarke, Building Tech.
L.D. Giffin, B.Sc.
R.J. Harris
K.E. Hellenbrand, Ph.D.
K. Howells, B.Sc., Ph.D.
G.R. Johnson, B.Sc.
G.D. Lutwick, B.Sc., M.Sc., Ph.D.
K.G. MacDonald, B.Sc.
A.G. McKay, B.Sc., M.Sc., Ph.D.
D.D. Prentiss, B.Sc., P.Eng.
F.M. Smith, Ag. Tech.
N.S. Stover, B.Sc., M.Sc., P.Eng.
R.W. Tizzard, B.Sc.

INDUSTRY SERVICES

Vice-President, Industry Services
J.R. Helliwell, A.C.S.M., P.Eng.

Secretaries
C.L. O'Connell
G.P. Woodgate

Field Service - IRAP
G.R. Archibald, B.Eng., P.Eng.
J.P. Archibald, B.Sc., B.Eng., P.Eng.
J.J. Marshall, B.Eng., P.Eng.
D.W. Martell, B.Eng., P.Eng.
R.D. Simmons, B.Sc. Agr.
M.W. Veling, B.Sc.
L.M. Williams, B.Eng., P.Eng.

Project Services
J.D. MacAulay, B.S.A., M.Sc., Ph.D., P.Ag., P.Eng.
T.K. Edmonds, B.Sc., B.Eng., P.Eng.
I.L. Hawboldt, B.Sc., M.Sc.
R.L. Roberts, B.Sc., M.B.A.

Technical People In Industry
I.W. Glass, B.Sc., B.Eng.

Library
H.I. Hendry, B.A., B.Lib.Sc.
J.F. Fitch, B.S.A.
M.C. MacDonald, B.A.

PRODUCT DEVELOPMENT

Vice-President, Product Development
C.R. Tyner, H.N.C., P.Eng.

Secretary
A.M. Munro

Engineering
J.H. Smith, P.Eng.
N.P. Richter, B.Eng., P.Eng.
E.A. Smallhorn, B.Eng., P.Eng.
J.B. Oliver, B.Sc.
A.J. Hines, Elect. Tech.

Electronics
J.T. Osborne, B.Sc., A.R.C.S., P.Eng.
C.A. Butler
R.G. Morash, B.Sc.

Drawing Office
W.A. Mills, Electromech. Draft.
J. Edwards
N. McFeters

Manufacturing
C.E. Isenor, Dip. Mach.
A.B. Johnson, Dip. Mach.
R.J. Conrod, Dip. Mach.
L.R. Hartlen, Dip. Mach.
R.A. Marks, Dip. Mach.
M.A. Wright, Dip. Mach.
D.K. Julien, Ind. Elect.
H. Porteous, Mech. Tech.

Marketing
D.S. Rankin, B.Sc., Ph.D.

Quality Control
H.G. James, Mech. Draft.